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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

COLAN, GIOVANNA B

ART UNIT PAPER NUMBER

2162

DATE MAILED: 03/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/673,529

Applicant(s)

FIENBLIT ET AL.

Examiner

Giovanna Colan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 29 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-48 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 02/16/2005.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. This action is issued in response to applicant filed application on 09/29/2003.
2. Claims 1 – 48 are pending.
3. The information disclosure statement (IDS) submitted on 02/16/2005. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
5. Claim 16, 32, and 48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term “substantially identical” recited in claim 16, 32, and 48, is a relative term which renders the claims indefinite. It is unclear what is the level of similarity claims refer to.

**Examiner asserts that all claims should be checked for clarification. Appropriate action is required.**

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claim 1 – 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Black (Black hereinafter) (US Patent No. 6,978,324 B1, filed: June 27, 2000) in view of Bakke et al. (Bakke hereinafter) (US Patent App. Pub. No. 2003/0023808 A1, filed: July 26, 2001).

Regarding Claim 1, Black discloses a method for managing a data storage system that includes primary (Fig. 11, item 111, Col. 19, lines 48 – 51, Black) and secondary storage subsystems (Fig. 11, item 112, Col. 19, lines 63 – 65, Black), including respective first and second storage media (Col. 18, lines 62 – 64, Black), the method comprising:

maintaining a record predictive of locations to which data are to be written on the primary storage subsystem by a host processor (Col. 27, lines 47 – 50 and 59 – 61, Black);

receiving the data from the host processor at the primary storage subsystem to be written to a specified location on the first storage media (Col. 28, lines 3 – 6, Black);

if the specified location is not included in the record, updating the record responsively to the specified location (Fig. 17, item 173 and 174, Col. 28, lines 19 – 21, Black);

signaling the host processor that the data have been stored in the data storage system responsively to receiving the data and, if the specified location was not included in the record, responsively to updating the record (Col. 28, lines 22 – 31, Black);

copying the data from the primary storage subsystem to the secondary storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black); and

storing the data in the specified location on both the first (Col. 19, lines 48 – 50, Black<sup>1</sup>) and second storage media (Col. 19, lines 63 – 65, Black).

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Black further discloses additional storage elements (Col. 18, lines 62 – 64, Black). However, Black is silent with respect to a non-volatile storage media. On the other hand, Bakke discloses storing data to a non-volatile storage media (Page 1, [0011], lines 2 – 4, Bakke). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate Bakke teachings' to Black's system. Skilled artisan would have been motivated to do so, as suggested by Bakke (Page 1, [0007] and [0008], lines 10 – 12 and 1 – 3; respectively, Bakke), to mirror and backup data between storage devices while maintaining data coherency and ensuring a "flawless" takeover in the event of a failure. In addition, Black's system and Bakke's system are analogous art because they belong to the same field of endeavor, such as, backing up and mirroring data between a plurality of storage devices, memory allocation, and database management systems. This close relation between both of the references highly suggests an expectation of success.

Regarding Claim 2, the combination of Black in view of Bakke discloses a method, wherein copying the data comprises transmitting the data between mutually-remote sites over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

Regarding Claim 3, the combination of Black in view of Bakke discloses a method, wherein copying the data comprises creating a mirror on the secondary storage

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<sup>1</sup> Black further discloses the step of storing the data in a specified location on the storage locations (Col.

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subsystem of the data received by the primary storage subsystem (Col. 29, lines 4 – 9, Black<sup>2</sup>; and Page 1, [0009], lines 15 – 18, Bakke).

Regarding Claim 4, the combination of Black in view of Bakke discloses a method, and comprising, upon occurrence of a failure in the primary storage subsystem, configuring the secondary storage subsystem to serve as the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 5, the combination of Black in view of Bakke discloses a method, and comprising, upon recovery of the system from a failure of the primary storage subsystem, conveying, responsively to the record, a portion of the data from the secondary storage subsystem to the primary storage subsystem for storage on the primary storage subsystem (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 6, the combination of Black in view of Bakke discloses a method, wherein maintaining and updating the record comprise marking respective bits in a bitmap corresponding to the locations to which the data are to be written on the first

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21, lines 30 – 33, Black).

<sup>2</sup> Wherein storage element corresponds to primary storage device, and destination storage element corresponds to secondary storage device.

and second non-volatile storage media (Col. 26, lines 20 – 25, Black<sup>3</sup>; and Page 2, [0011], lines 9 – 13, Bakke).

Regarding Claim 7, the combination of Black in view of Bakke discloses a method, wherein maintaining the record comprises storing the record on the first non-volatile storage media (Page 27, lines 47 – 50 and 59 – 61, Black), and wherein updating the record comprises modifying the record that is stored on the first non-volatile storage media (Col. 28, lines 15 – 18, Black).

Regarding Claim 8, the combination of Black in view of Bakke discloses a method, wherein modifying the record comprises:

comparing the specified location to a copy of the record held in a volatile memory on the primary storage subsystem (Col. 28, lines 7 – 8, Black);

modifying the copy of the record so that at least the specified location is included in the copy of the record (Col. 28, lines 24 – 28, Black<sup>4</sup>); and

destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black<sup>5</sup>).

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<sup>3</sup> Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

<sup>4</sup> Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of modifying the copy of the record to specify the location as claimed.

<sup>5</sup> Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).



Regarding Claim 9, the combination of Black in view of Bakke discloses a method, wherein the record is not modified on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

Regarding Claim 10, the combination of Black in view of Bakke discloses a method, wherein modifying the record comprises adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 11, the combination of Black in view of Bakke discloses a method, wherein updating the record comprises predicting one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black<sup>6</sup>), and adding the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 12, the combination of Black in view of Bakke discloses a method, wherein predicting the one or more further locations comprises selecting a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

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<sup>6</sup> Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

Regarding Claim 13, the combination of Black in view of Bakke discloses a method, wherein maintaining the record comprises recording the locations to which the data are written using an object-based storage technique (Col. 24, lines 11 – 18, Black), and wherein predicting the one or more further locations comprises choosing the one or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black<sup>7</sup>).

Regarding Claim 14, the combination of Black in view of Bakke discloses a method, wherein updating the record comprises removing one or more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 15, the combination of Black in view of Bakke discloses a method, wherein removing the one or more locations comprises receiving an acknowledgment from the secondary storage subsystem that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and removing the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45, Black<sup>8</sup>).

Regarding Claim 16, the combination of Black in view of Bakke discloses a method, wherein removing the one or more locations comprises identifying the locations

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<sup>7</sup> Wherein permitting identification corresponds to choosing the locations claimed.

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at which the first and second non-volatile storage media contain substantially identical data (Col. 26, lines 21 – 23, Black), and selecting for removal one of the identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black<sup>9</sup>).

Regarding Claim 17, the combination of Black in view of Bakke discloses a data storage system, comprising:

a primary storage subsystem (Fig. 11, item 111, Col. 19, lines 48 – 51, Black), which comprises first non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke); and

a secondary storage subsystem (Fig. 11, item 112, Col. 19, lines 63 – 65, Black), which comprises second non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke),

wherein the primary storage subsystem is arranged to receive data from a host processor for writing to a specified location (Col. 27, lines 3 – 6, Black), and to store the data in the specified location on the first non-volatile storage media while copying the data to the second storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black; and Page 1, [0011], lines 2 – 4, Bakke), which is arranged to store the data in the specified location on the second non-volatile storage media (Col. 19, lines 63 – 65, Black), and

wherein the primary storage subsystem is arranged to maintain a record predictive of locations to which data are to be written on the primary storage subsystem

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<sup>9</sup> Wherein the step of releasing the memory corresponds to the step of removing the locations.

by the host processor (Col. 27, lines 47 – 50 and 59 – 61, Black), and upon receiving the data from the host processor (Col. 27, lines 47 – 50, Black) , to update the record responsively to the specified location if the specified location is not included in the record (Fig. 17, item 173 and 174, Col. 28, lines 19 – 21, Black), and to signal the host processor that the data have been stored in the data storage system responsively to receiving the data and, if the specified location was not included in the record, responsively to updating the record (Col. 28, lines 22 – 31, Black).

Regarding Claim 18, the combination of Black in view of Bakke discloses a system, wherein the first and second non-volatile storage media are located at mutually-remote sites, and wherein the instructions cause at least one of the first and second control units to transmit the data over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

Regarding Claim 19, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first and second control units to mirror the data held by the primary storage subsystem on the secondary storage subsystem (Col. 29, lines 4 – 9, Black<sup>10</sup>; and Page 1, [0009], lines 15 – 18, Bakke).

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<sup>9</sup> Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In addition, the removing step is cited in Col. 28, line 45, Black.

<sup>10</sup> Wherein storage element corresponds to primary storage device, and destination storage element corresponds to secondary storage device.

Regarding Claim 20, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the secondary storage subsystem, upon occurrence of a failure in the primary storage subsystem, to serve as the primary storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 21, the combination of Black in view of Bakke discloses a system, wherein upon recovery of the system from a failure of the primary storage subsystem, the instructions cause the second control unit to convey, responsively to the record, a portion of the data from the second non-volatile storage media to the primary storage subsystem for storage on the first non-volatile storage media (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 22, the combination of Black in view of Bakke discloses a system, wherein the record comprises a bitmap, and wherein the instructions cause the first control unit to mark respective bits in the bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media (Col. 26, lines 20 – 25, Black<sup>11</sup>; and Page 2, [0011], lines 9 – 13, Bakke).

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<sup>11</sup> Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

Regarding Claim 23, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit to store (Page 27, lines 47 – 50 and 59 – 61, Black) and update the record on the first non-volatile storage media (Col. 28, lines 15 – 18, Black).

Regarding Claim 24, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit to hold a copy of the record in a volatile memory of the primary storage subsystem (Col. 28, lines 7 – 8, Black), and to update the record by modifying the copy of the record (Col. 28, lines 24 – 28, Black<sup>12</sup>), and destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black<sup>13</sup>).

Regarding Claim 25, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit not to modify the record on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

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<sup>12</sup> Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of updating the copy of the record to specify the location as claimed.

<sup>13</sup> Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).

Regarding Claim 26, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit, when the specified location is not included in the record, to update the record in the first non-volatile storage media by adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 27, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit, when the specified location is not included in the record, to predict one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black<sup>14</sup>), and to add both the specified location and the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 28, the combination of Black in view of Bakke discloses a system, wherein the one or more further locations predicted by the first control unit comprise a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

Regarding Claim 29, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit to maintain the record using an object-based storage technique (Col. 24, lines 11 – 18, Black), and to predict the one

or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black<sup>15</sup>).

Regarding Claim 30, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit, upon updating the record, to remove one or more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 31, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the second control unit to transmit an acknowledgment to the primary storage subsystem indicating that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and further cause the first control unit to remove the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45, Black<sup>16</sup>).

Regarding Claim 32, the combination of Black in view of Bakke discloses a system, wherein the instructions cause the first control unit to identify the locations at which the first and second non-volatile storage media contain substantially identical

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<sup>14</sup> Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

<sup>15</sup> Wherein permitting identification corresponds to choosing the locations claimed.

<sup>16</sup> Wherein the step of releasing the memory corresponds to the step of removing the locations.



data (Col. 26, lines 21 – 23, Black), and to remove from the record one of the identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black<sup>17</sup>).

Regarding Claim 33, the combination of Black in view of Bakke discloses a computer software product for use in a data storage system including primary (Fig. 11, items 111, Col. 19, lines 48 – 51, Black) and secondary storage subsystems (Fig. 11, items 112, Col. 19, lines 63 – 65, Black), which include respective first and second control units (Col. 18, lines 25 – 29, Black) and respective first and second non-volatile storage media (Col. 18, lines 62 – 64, Black; and Page 1, [0011], lines 2 – 4, Bakke), the product comprising a computer-readable medium in which program instructions are stored, which instructions, when read by the first and second control units, cause the first control unit to receive data from a host processor for writing to a specified location (Col. 27, lines 3 – 6, Black), and to store the data in the specified location on the first non-volatile storage media while copying the data to the second storage subsystem (Fig. 21A, items 212 and 213, Col. 29, lines 4 – 9, Black; and Page 1, [0011], lines 2 – 4, Bakke), and cause the second control unit to store the data in the specified location on the second non-volatile storage media (Col. 19, lines 63 – 65, Black),

wherein the instructions further cause the first control unit to maintain a record predictive of locations to which data are to be written on the primary storage subsystem by the host processor (Col. 27, lines 47 – 50 and 59 – 61, Black), and upon receiving the data from the host processor (Col. 27, lines 47 – 50, Black), to update the record

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<sup>17</sup> Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In

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responsively to the specified location if the specified location is not included in the record (Fig. 17, item 173 and 174, Col. 28, lines 19 – 21, Black), and to signal the host processor that the data have been stored in the data storage system responsively to receiving the data and, if the specified location was not included in the record, responsively to updating the record (Col. 28, lines 22 – 31, Black).

Regarding Claim 34, the combination of Black in view of Bakke discloses a product, wherein the first and second non-volatile storage media are located at mutually-remote sites, and wherein the instructions cause at least one of the first and second control units to transmit the data over a communication link between the sites (Col. 17, lines 9 – 12, Black; and Page 1 and 4, [0009] and [0033], lines 20 – 23 and 26 – 29; respectively, Bakke).

Regarding Claim 35, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first and second control units to mirror the data held by the primary storage subsystem on the secondary storage subsystem (Col. 29, lines 4 – 9, Black<sup>18</sup>; and Page 1, [0009], lines 15 – 18, Bakke).

Regarding Claim 36, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the secondary storage subsystem, upon occurrence of a failure in the primary storage subsystem, to serve as the primary

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addition, the removing step is cited in Col. 28, line 45, Black.

storage subsystem so as to receive further data from the host processor to be stored by the data storage system (Page 3, [0026], lines 23 – 32, Bakke).

Regarding Claim 37, the combination of Black in view of Bakke discloses a product, wherein upon recovery of the system from a failure of the primary storage subsystem, the instructions cause the second control unit to convey, responsively to the record, a portion of the data from the second non-volatile storage media to the primary storage subsystem for storage on the first non-volatile storage media (Page 6, [0044], lines 11 – 16, Bakke).

Regarding Claim 38, the combination of Black in view of Bakke discloses a product, wherein the record comprises a bitmap, and wherein the instructions cause the first control unit to mark respective bits in the bitmap corresponding to the locations to which the data are to be written on the first and second non-volatile storage media (Col. 26, lines 20 – 25, Black<sup>18</sup>; and Page 2, [0011], lines 9 – 13, Bakke).

Regarding Claim 39, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit to store (Page 27, lines 47 – 50 and 59 – 61, Black) and update the record on the first non-volatile storage media

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<sup>18</sup> Wherein storage element corresponds to primary storage device, and destination storage element corresponds to secondary storage device.

<sup>19</sup> Examiner interprets the step of adding a layer of mapping when the same number of bits is found, as a step for marking the bits.

(Col. 28, lines 15 – 18, Black).

Regarding Claim 40, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit to hold a copy of the record in a volatile memory of the primary storage subsystem (Col. 28, lines 7 – 8, Black), and to update the record by modifying the copy of the record (Col. 28, lines 24 – 28, Black<sup>20</sup>), and destaging the modified copy of the record to the first non-volatile storage media (Col. 28, lines 24 – 25, Black<sup>21</sup>).

Regarding Claim 41, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit not to modify the record on the first non-volatile storage media responsively to receiving the data as long as the specified location to which the data are to be written is included in the record (Col. 28, lines 7 – 11, Black).

Regarding Claim 42, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit, when the specified location is not included in the record, to update the record in the first non-volatile storage media

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<sup>20</sup> Wherein the step of updating the information containing the locations and forwarding the addresses corresponds to the step of updating the copy of the record to specify the location as claimed.

<sup>21</sup> Examiner interprets the step of forwarding the new updated address (Col. 28, lines 24 – 25, Black) as the step of destaging the modified copy of the record claimed. The new updated address corresponds to the modified record. In addition, Black discloses the record of locations in the primary storage (Col. 27, lines 59 – 64, Black).

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by adding a plurality of locations, including the specified location, to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 43, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit, when the specified location is not included in the record, to predict one or more further locations to which the host processor is expected to write the data in a subsequent write operation (Col. 25, lines 45 – 50, Black<sup>22</sup>), and to add both the specified location and the one or more further locations to the record (Col. 25, lines 60 – 63, Black).

Regarding Claim 44, the combination of Black in view of Bakke discloses a product, wherein the one or more further locations predicted by the first control unit comprise a predetermined number of consecutive locations in proximity to the specified location (Col. 25, lines 10 – 19, Black).

Regarding Claim 45, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit to maintain the record using an object-based storage technique (Col. 24, lines 11 – 18, Black), and to predict the one or more further locations based on a logical connection between storage objects (Col. 24, lines 53 – 57, Black<sup>23</sup>).

Regarding Claim 46, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit, upon updating the record, to remove one or more locations, other than the specified location, from the record, so as to limit a size of the record (Col. 21, lines 53 – 57, Black).

Regarding Claim 47, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the second control unit to transmit an acknowledgment to the primary storage subsystem indicating that the data have been stored in the one or more locations on the second non-volatile storage media (Col. 24, lines 58 – 62, Black), and further cause the first control unit to remove the one or more locations from the record responsively to the acknowledgment (Col. 28, line 45, Black<sup>24</sup>).

Regarding Claim 48, the combination of Black in view of Bakke discloses a product, wherein the instructions cause the first control unit to identify the locations at which the first and second non-volatile storage media contain substantially identical data (Col. 26, lines 21 – 23, Black), and to remove from the record one of the identified locations that was least-recently added to the record (Col. 24, lines 55 – 58, Black<sup>25</sup>).

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<sup>22</sup> Examiner interprets the step of examining the table to determine the location as the step of predicting the location claimed.

<sup>23</sup> Wherein permitting identification corresponds to choosing the locations claimed.

<sup>24</sup> Wherein the step of releasing the memory corresponds to the step of removing the locations.

<sup>25</sup> Wherein examiner interprets accessed records (disclosed by Black) as added records claimed. In addition, the removing step is cited in Col. 28, line 45, Black.

***Prior Art Made Of Record***

1. Black (US Patent No. 6,978,324 B1, filed: June 27, 2000) discloses a method and apparatus for controlling read and write accesses to a logical entity.
2. Bakke et al. (US Patent App. Pub. No. 2003/0023808 A1, filed: July 26, 2001) discloses a method and system for maintaining data coherency in a dual input/output adapter utilizing clustered adapters.
3. Dunham (US Patent No. 6,269,431 B1) discloses a virtual storage and block level direct access of secondary storage for recovery of backup data.
4. Boothby (US Patent No. 6,799,190 B1) discloses synchronizing databases.
5. Federwisch et al. (US Patent No. 6,993,539 B2) discloses a system and method for determining changes in two snapshots and for transmitting changes to destination snapshots.
6. Non-Patent Literature: Minwen et al., "Seneca: remote mirroring done write", Proceedings of USENIX Technical Conference, (San Antonio, TX), June 2003, USENIX, Berkley, CA.

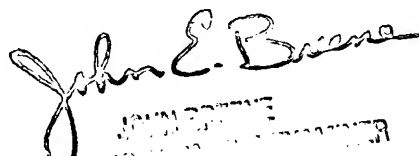
***Points Of Contact***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Giovanna Colan whose telephone number is (571) 272-2752. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Breene can be reached on (571) 272-4107. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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